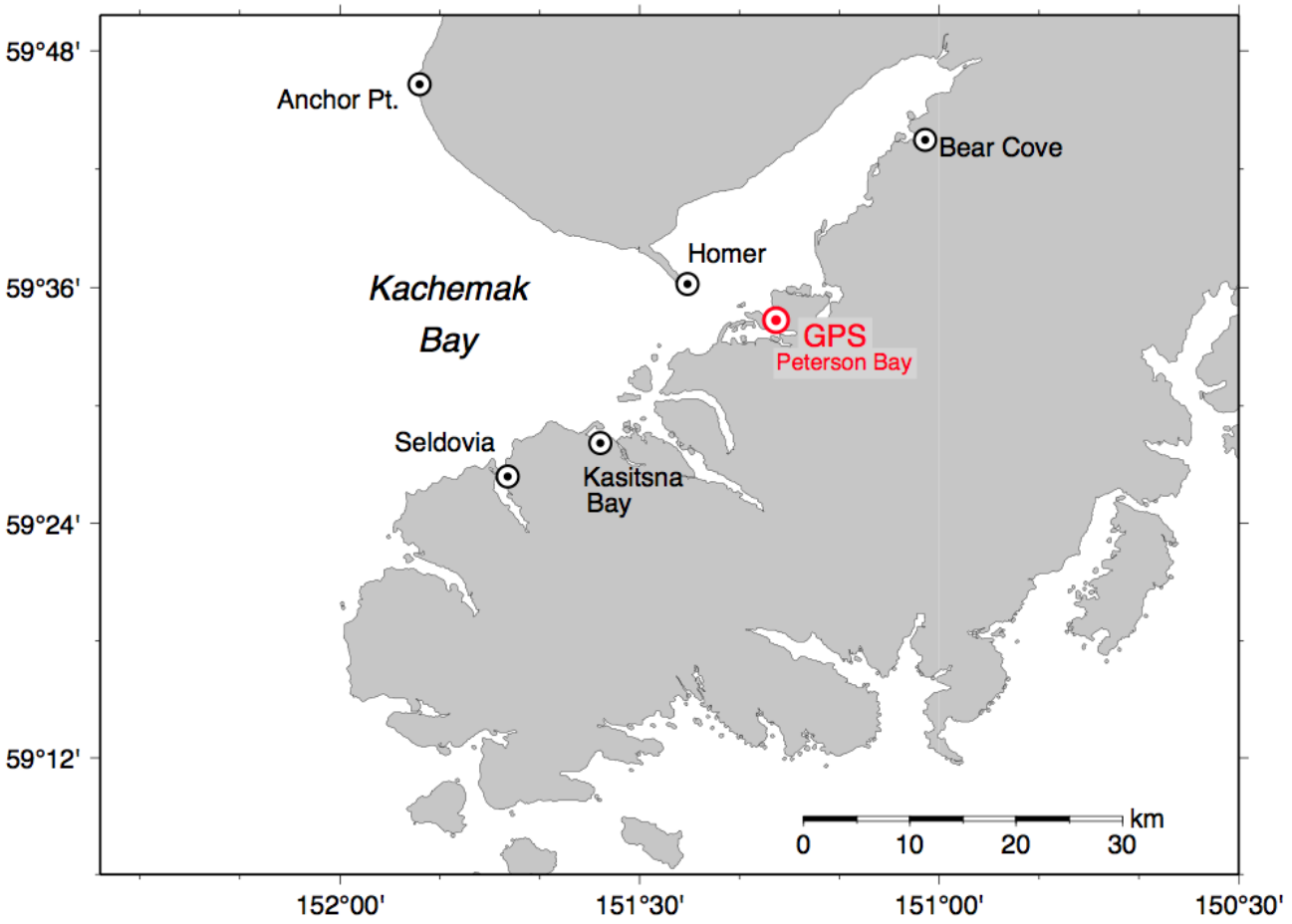
Topics

- Side track: Peterson Bay GPS as an accidental tide gauge
- Update on observations: Homer Spit
- Modeling goals: estimate post-1964 change and project present observations to the future
- Model development process
  - Glacial isostatic adjustment model
  - Tectonic/Postseismic Model
- Validation Steps

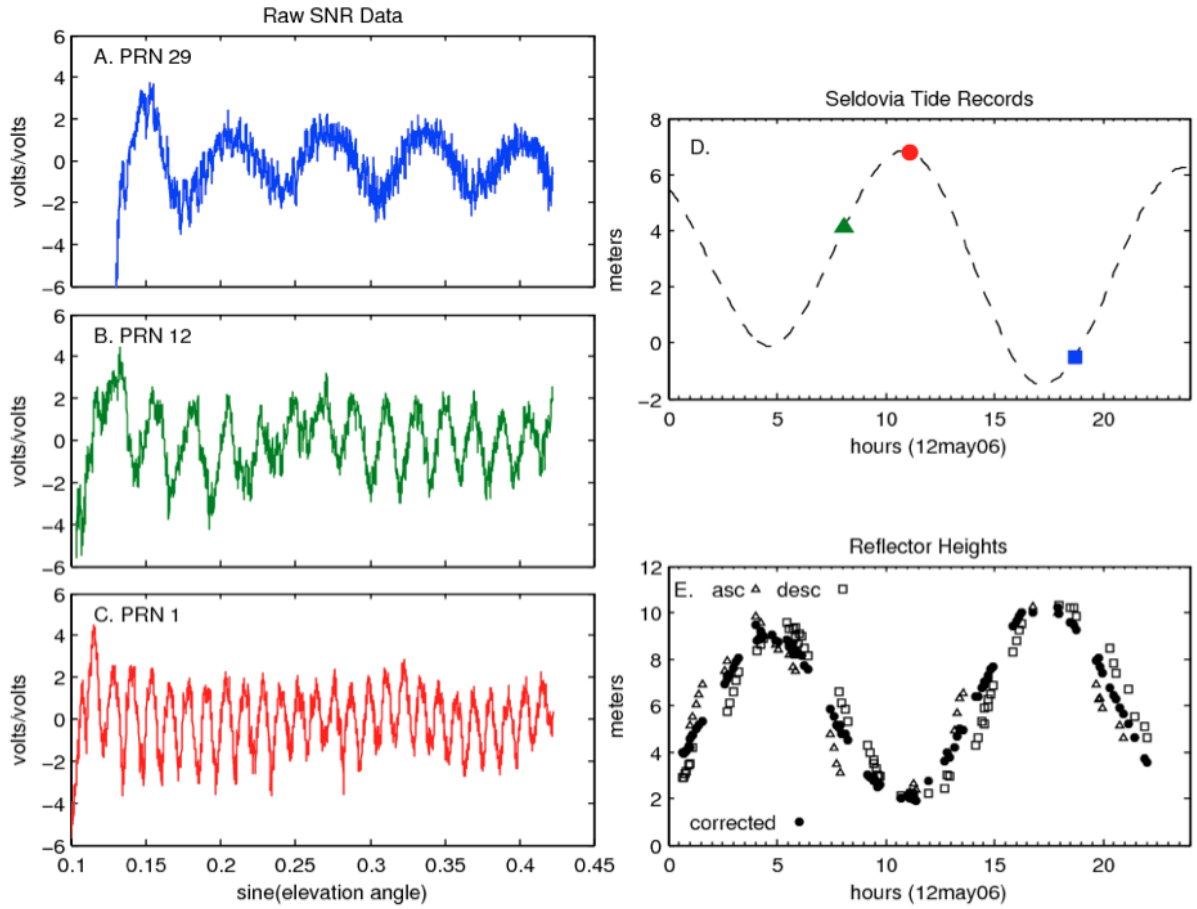
PBAY: An Accidental Tide Gauge

Work led by Dr. Kristine Larson, University of Colorado

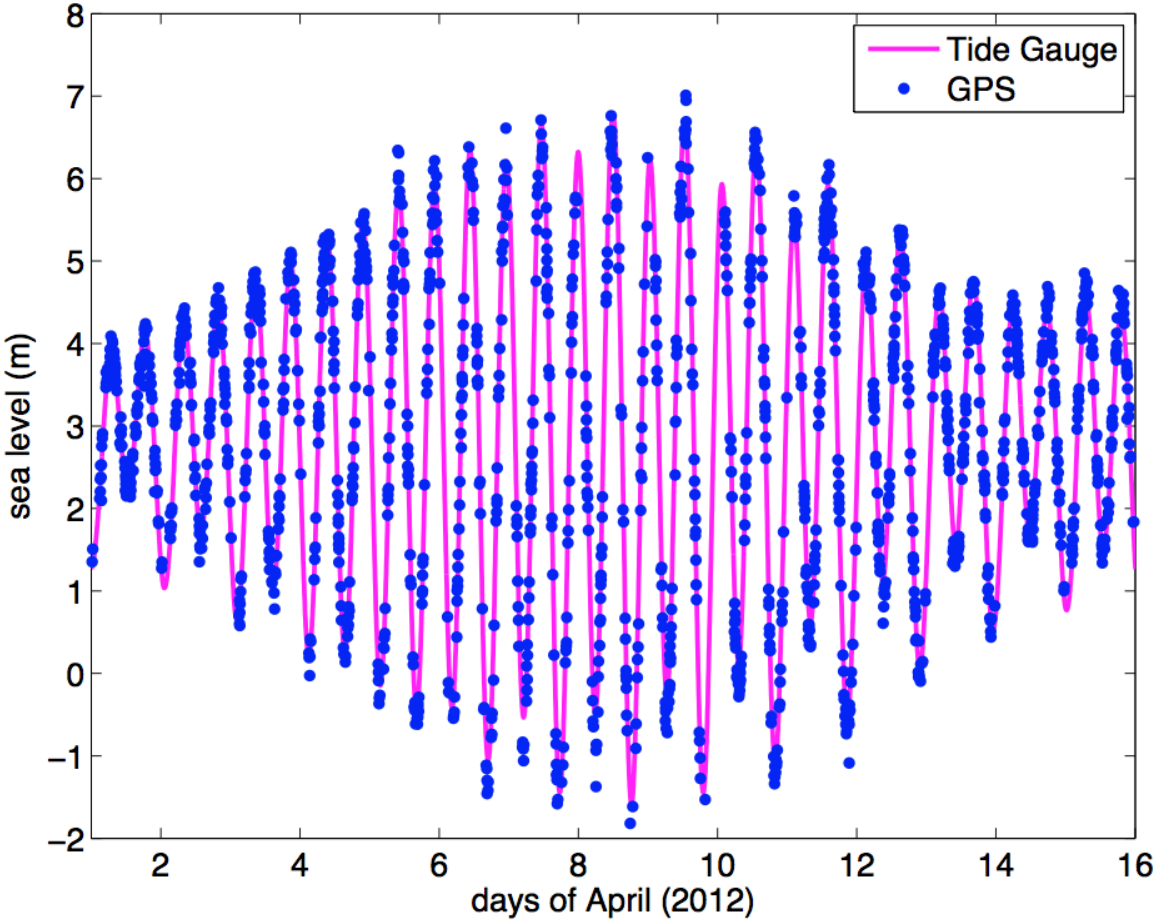
Location Map



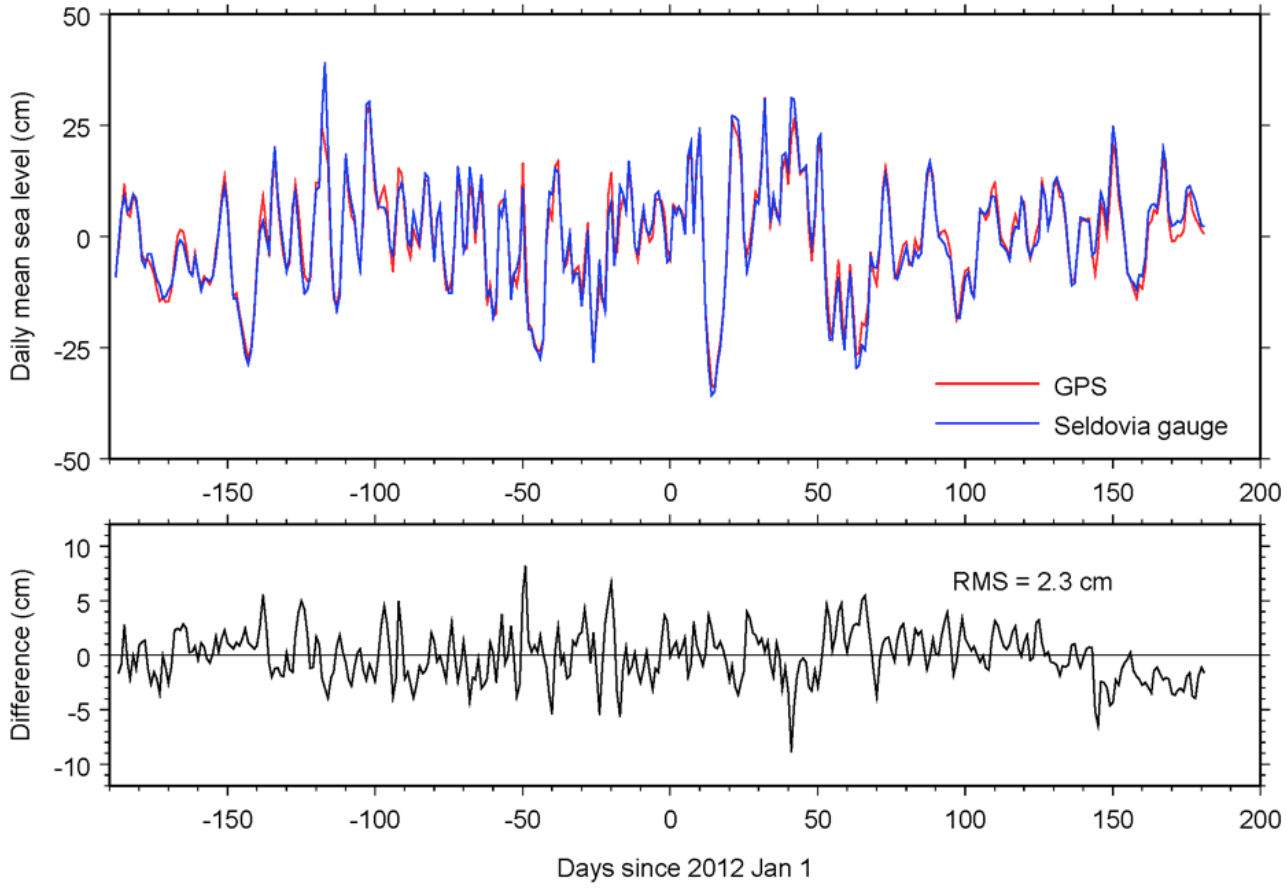
Signal to Noise Ratio



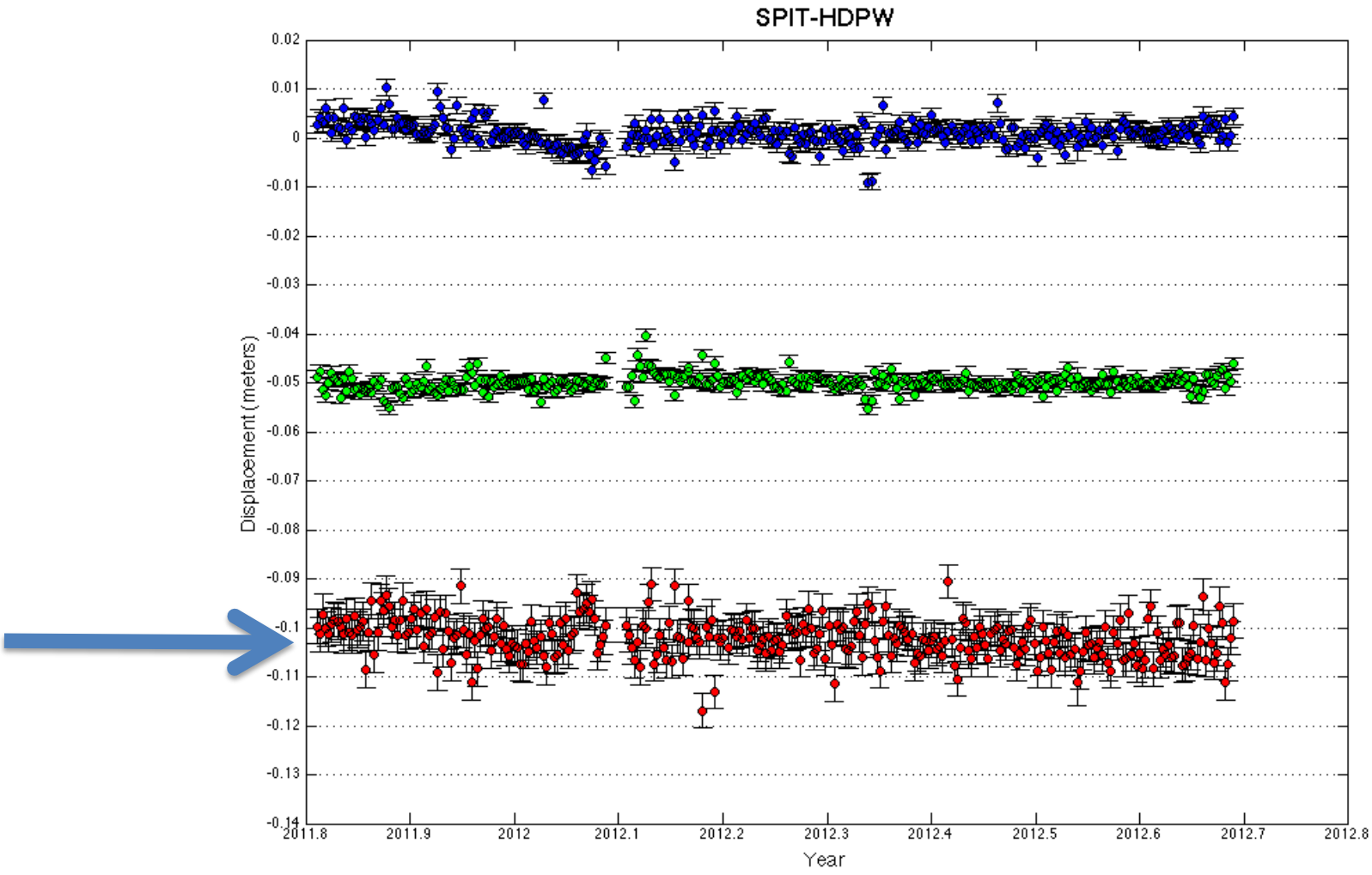
GPS as a Tide Gauge



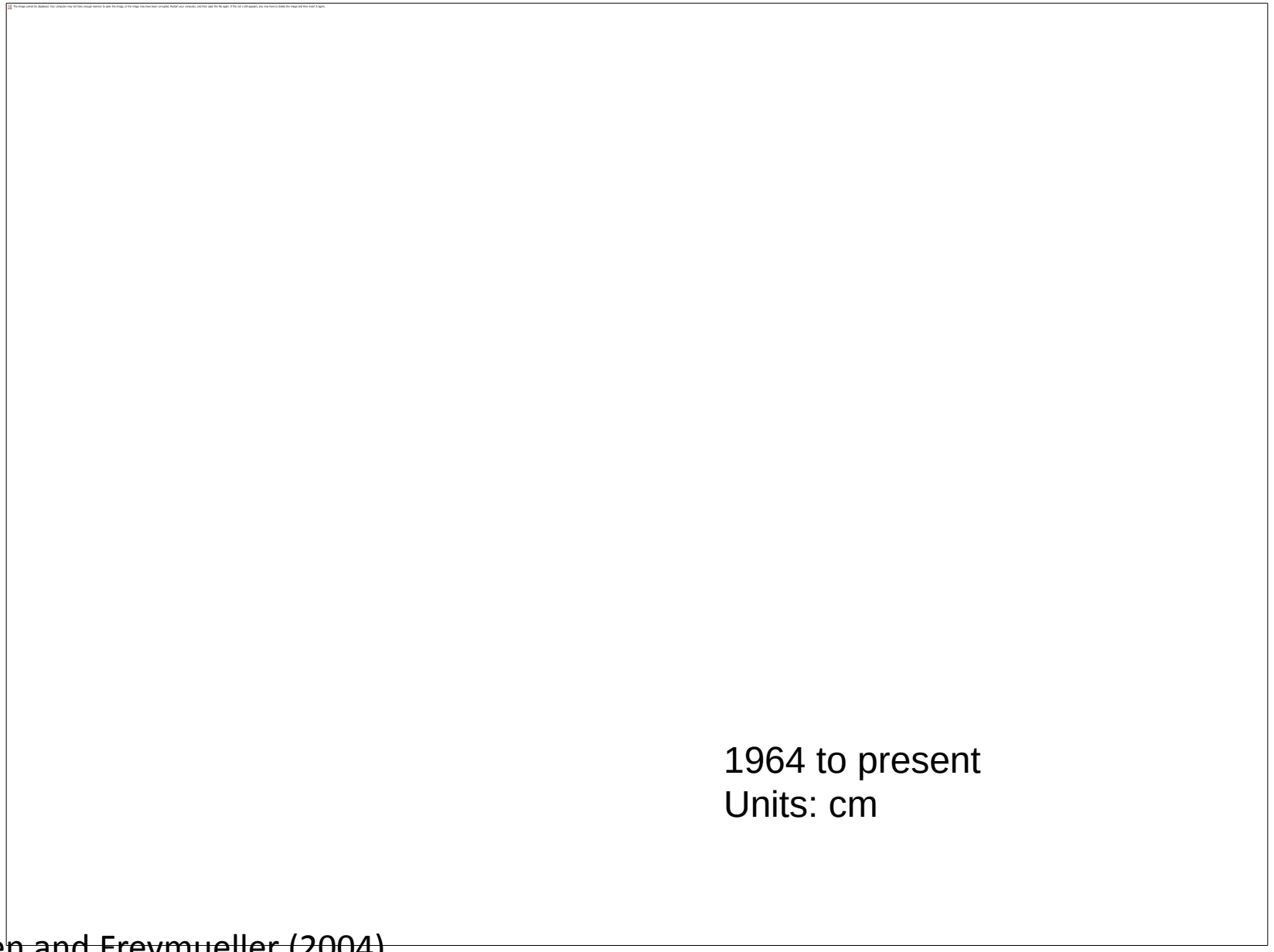
Daily Mean Sea Level



Subsidence of the Spit



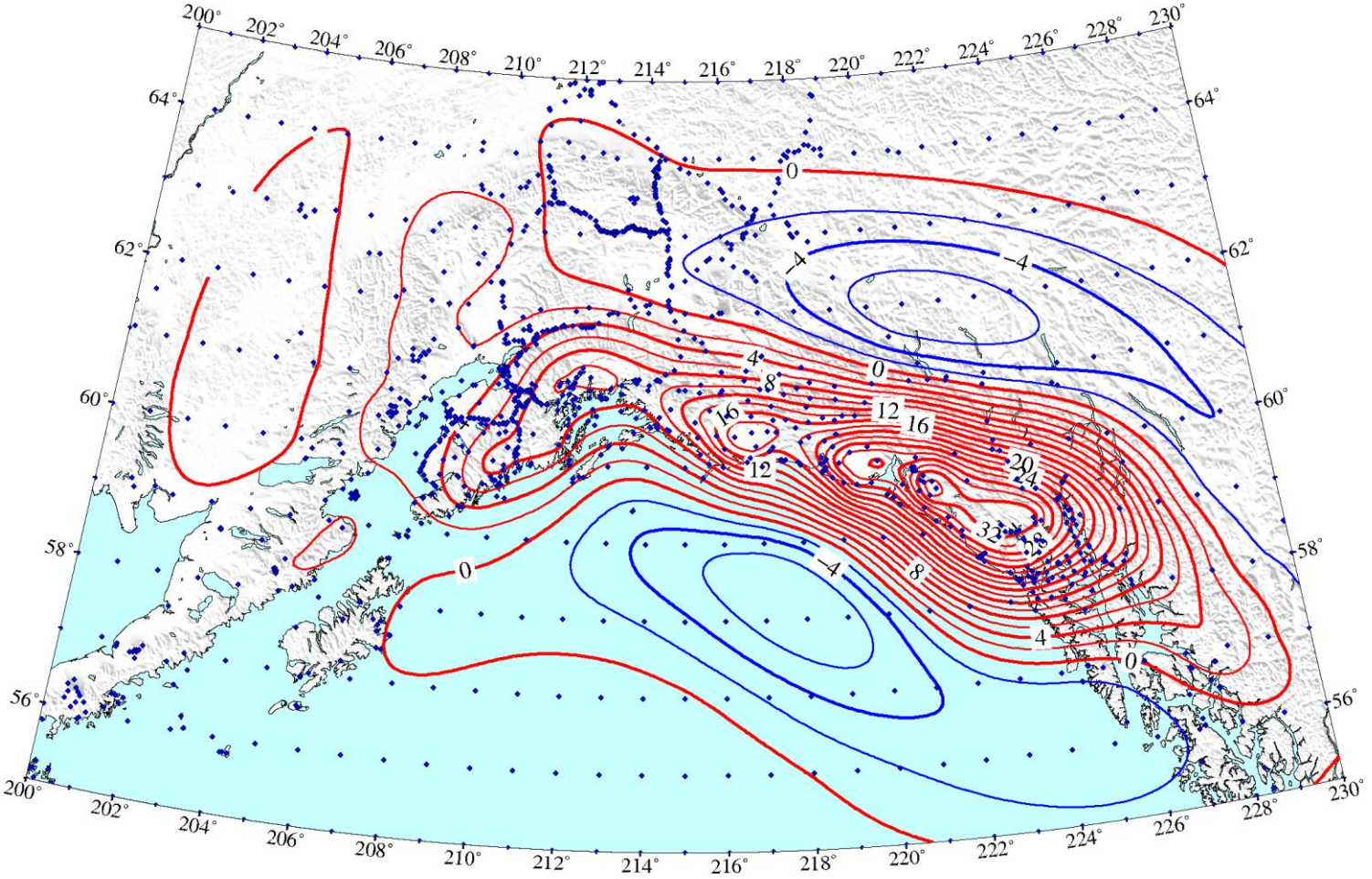
Total Post-1964 Postseismic Uplift



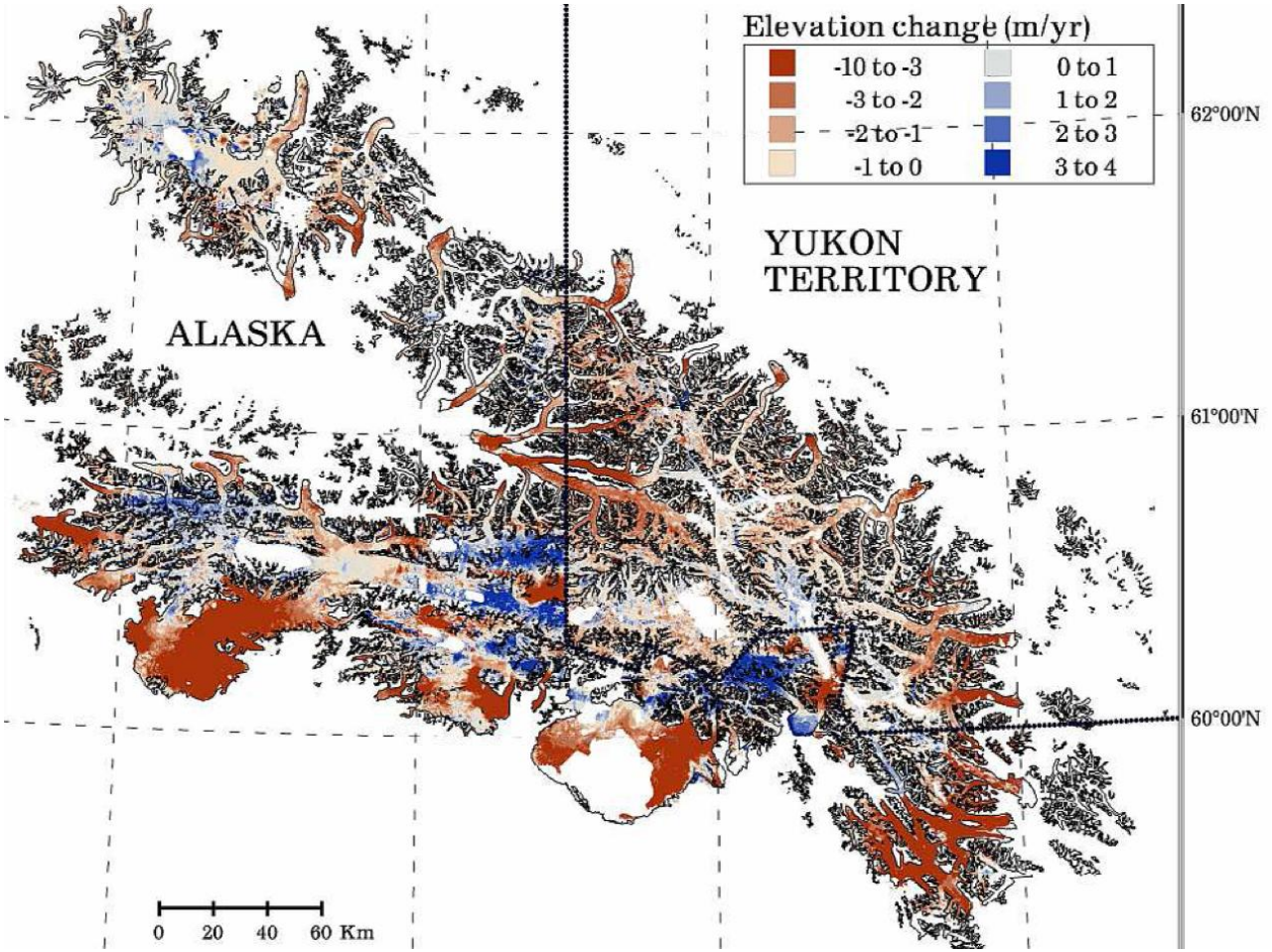
1964 to present
Units: cm

Cohen and Freymueller (2004)

GIA Predicted Uplift/Subsidence Rates



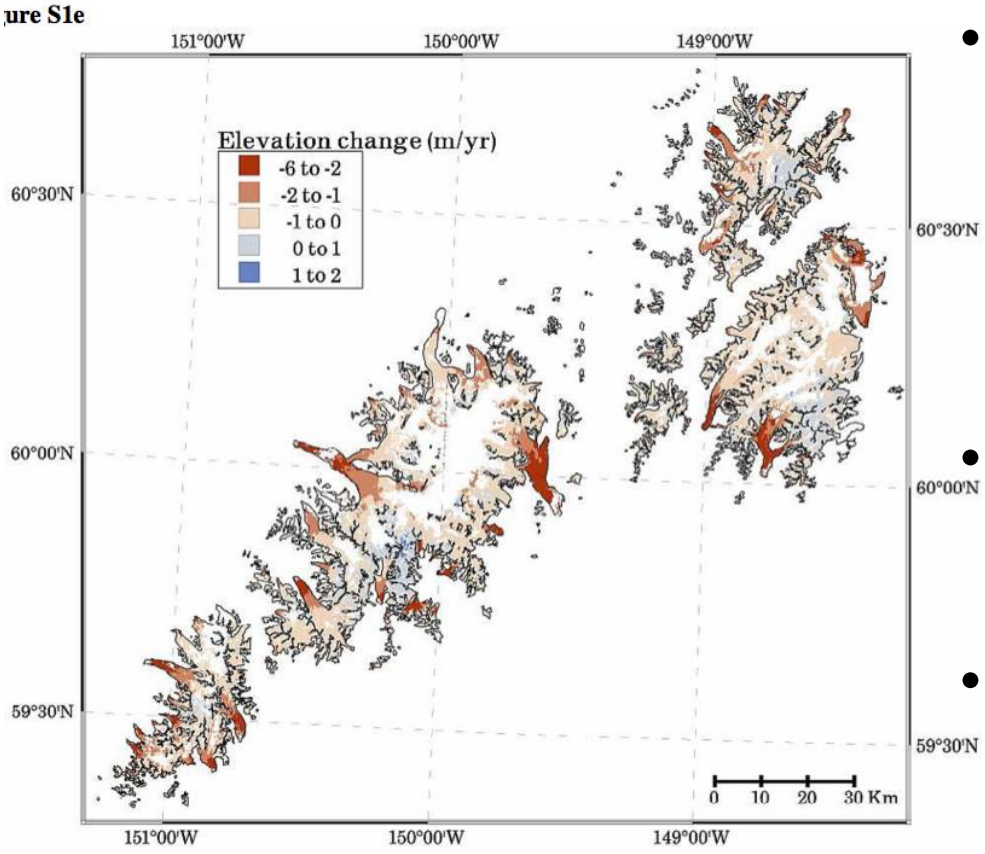
Improved Ice Unloading Model



Berthier et al., 2010

Improving the Model

Ice Losses: Kenai Mountains

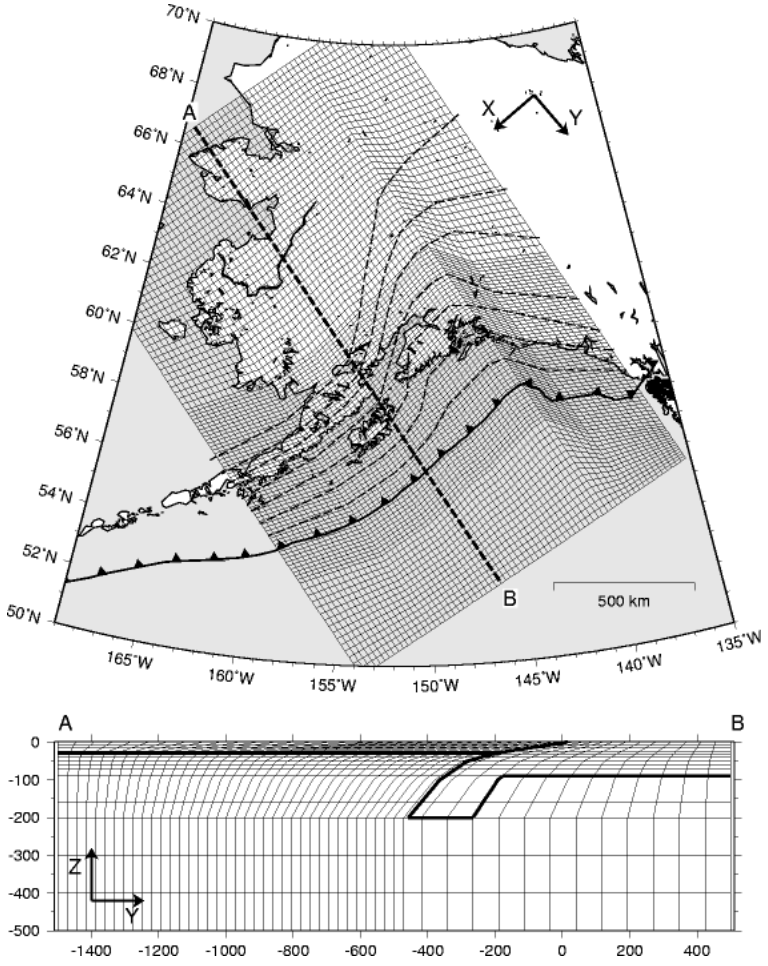


iEOSCIENCE | www.nature.com/naturegeoscience

Procedure

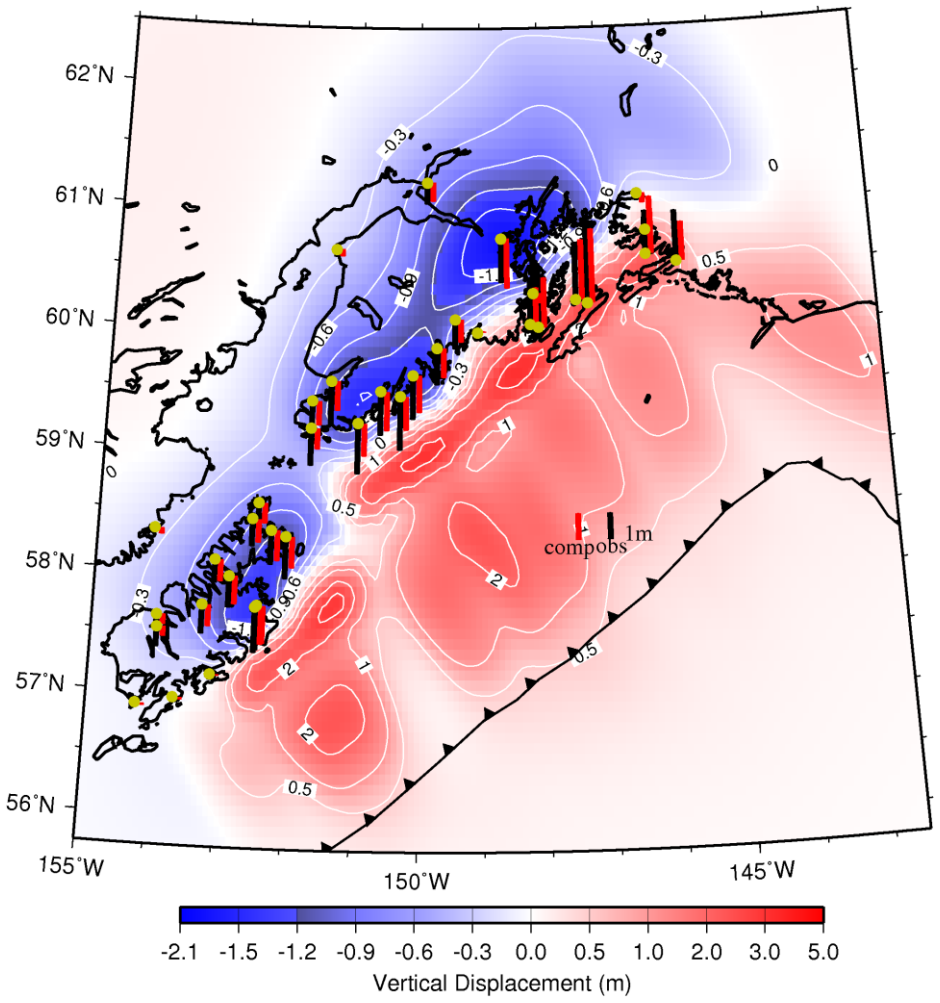
- Use the new ice model and extensive GPS data in southeast Alaska to estimate Earth model
  - elastic layer over viscoelastic upper mantle
- Recompute the model predictions over all of Southern Alaska
- *Key challenge: variability in uplift rate over the last 15 years*

Viscoelastic Model



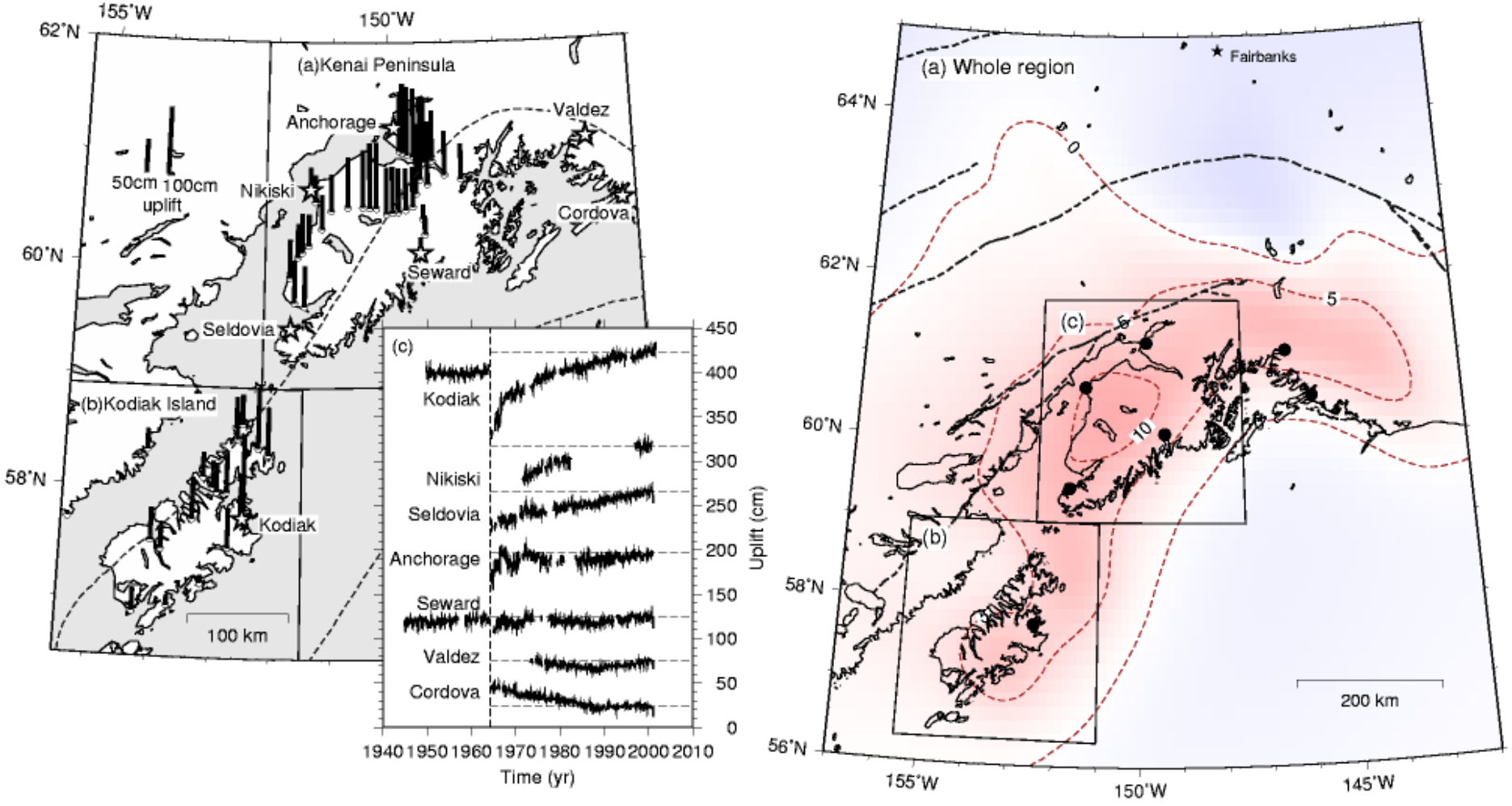
- Key element of model is the inclusion of 3D geometry including **elastic slab**.
- Driven by coseismic model
- Large model domain – takes a very long time to run
- Suito and Freymueller (2009)

New Coseismic/Postseismic Model

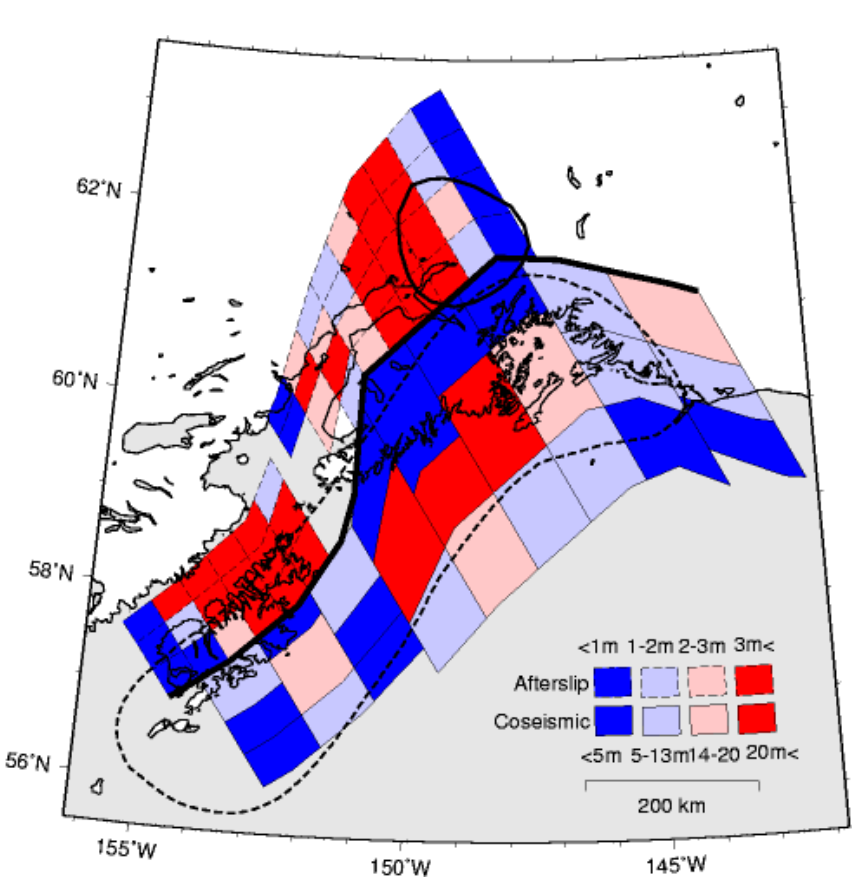


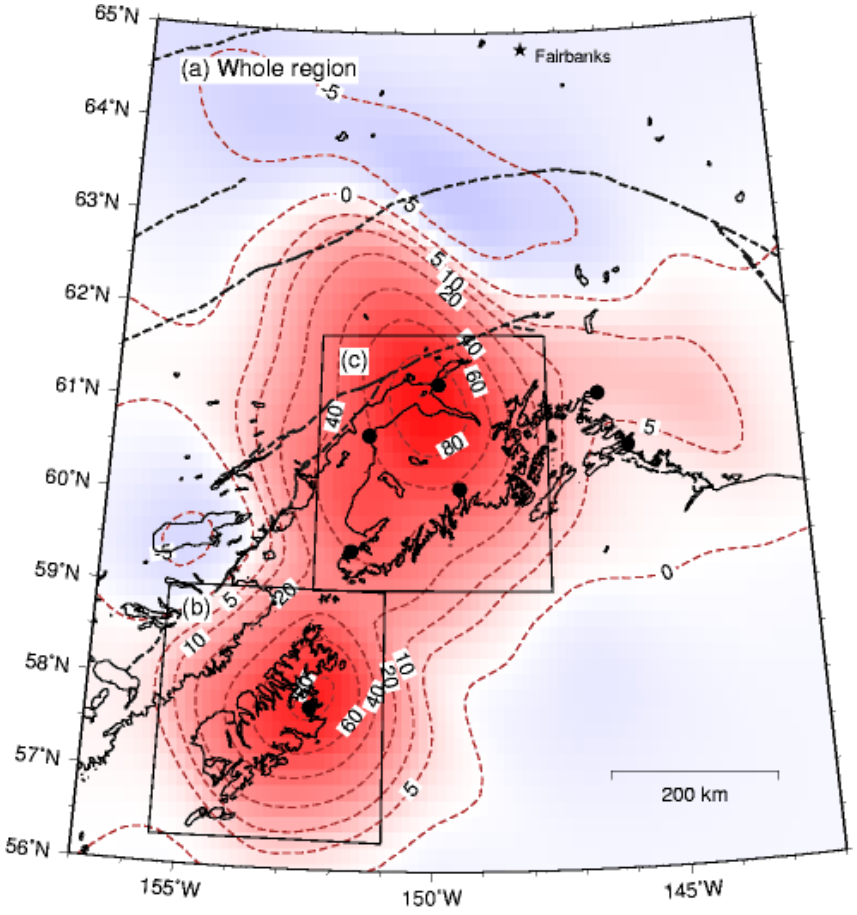
- New coseismic model
- Viscoelastic postseismic model using FEM
- Model includes afterslip history using various time decay functions
- Investigate relative importance of afterslip and viscoelastic relaxation
- Data
  - Cumulative Postseismic Uplift
  - Present-day velocities
  - Tide gauge uplift histories

Cumulative Postseismic Uplift

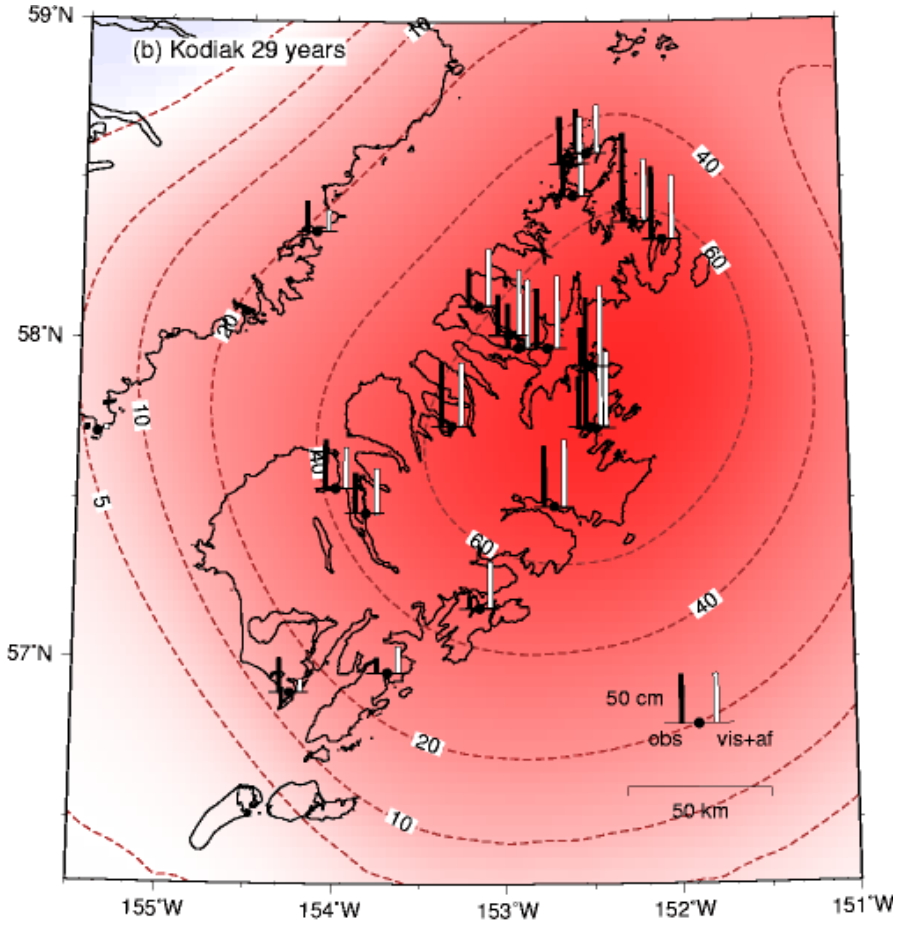


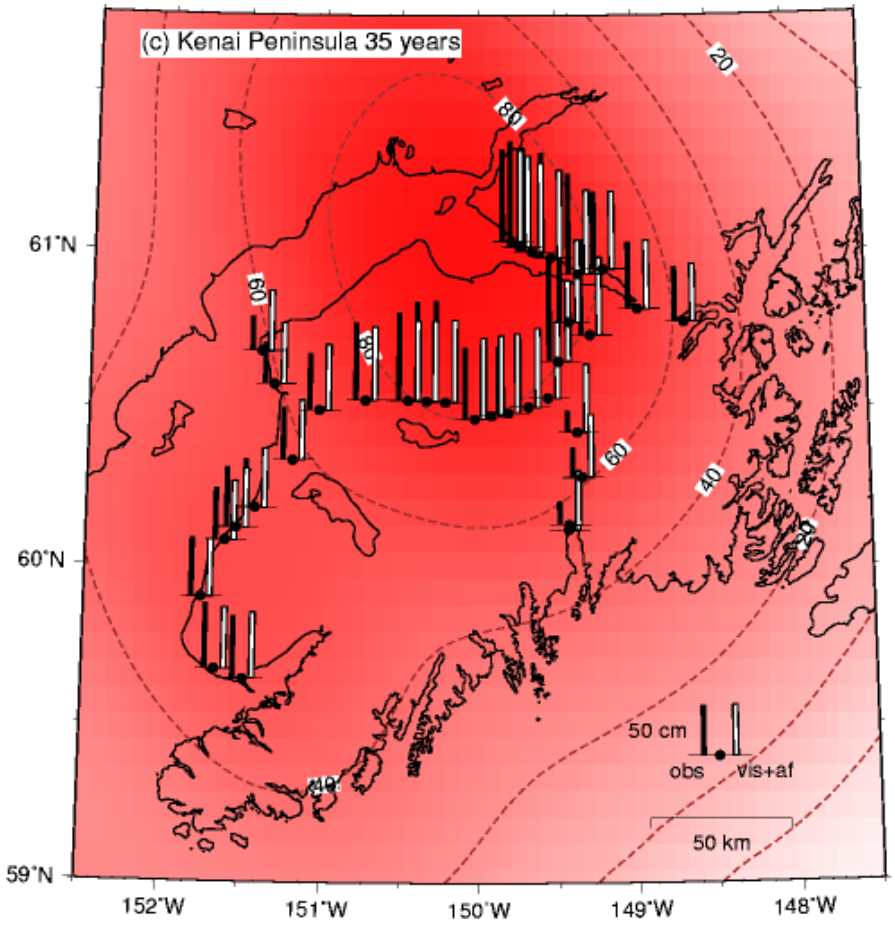
Coseismic + Afterslip Model



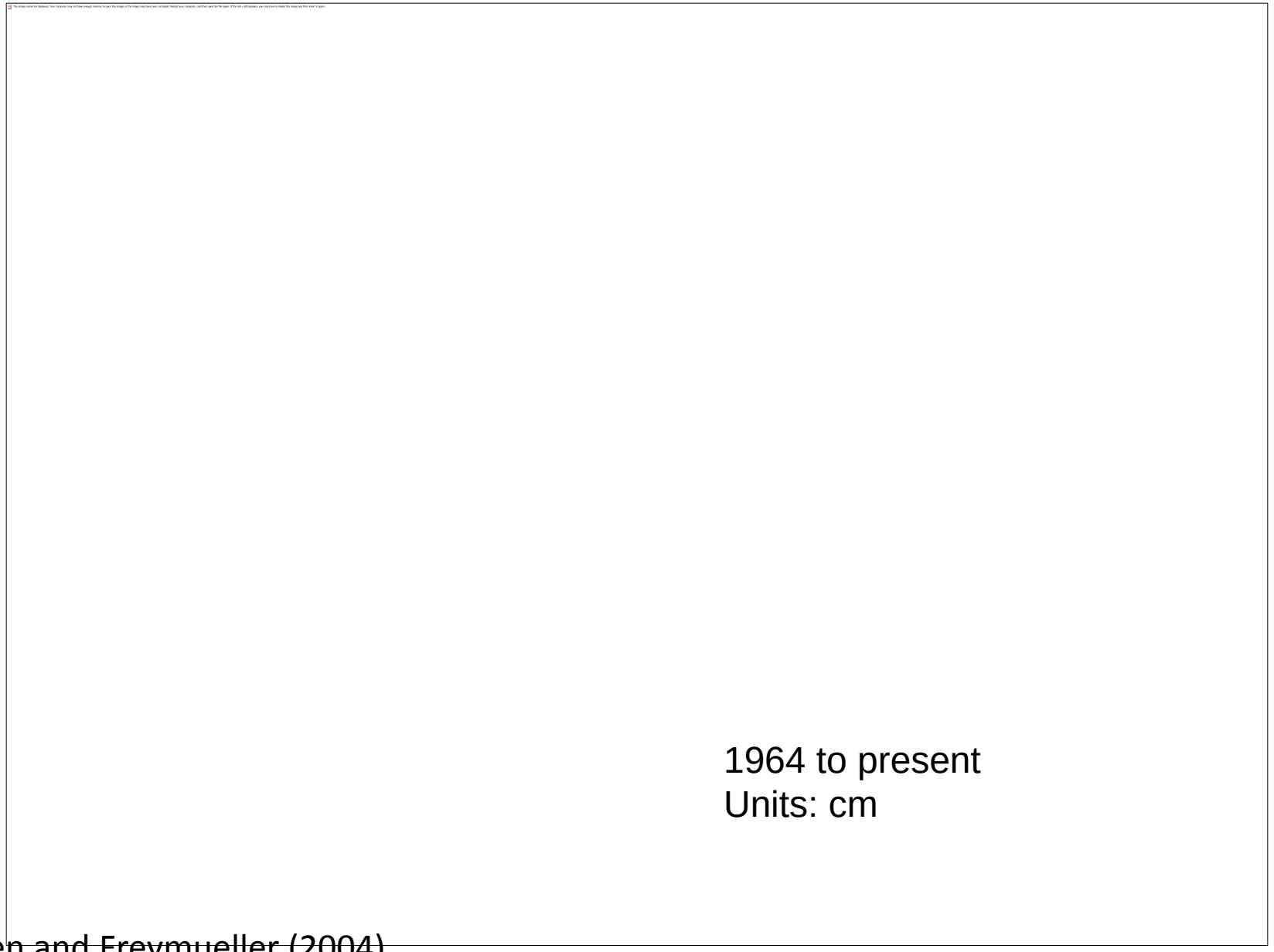


Comparison to Data





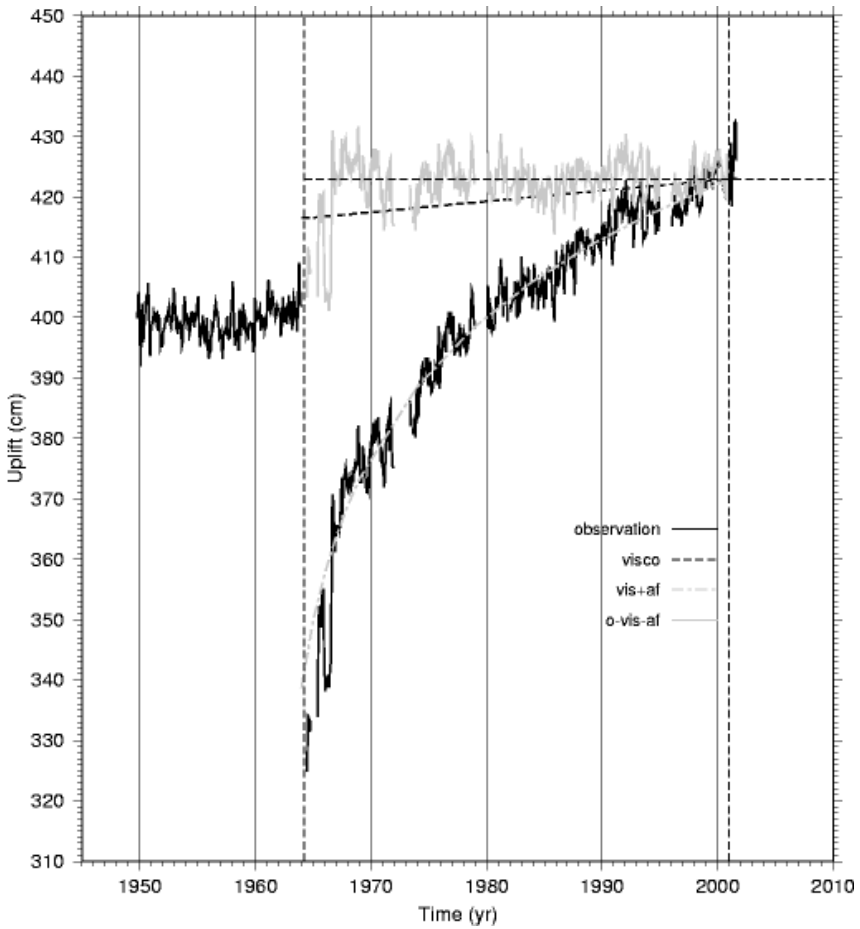
Total Post-1964 Postseismic Uplift



1964 to present
Units: cm

Cohen and Freymueller (2004)

Time History of Uplift



Kodiak tide gauge record

- Black curve: observations
- Gray curve: after removing all current models
- Uplift rate has declined with time
- Postseismic model successfully predicts the change in rate
  - Can extrapolate to the future with confidence

Next Steps

- Finish improved ice model (Fall 2012)
- Add present-day predictions of postseismic and tectonic models to glacial isostatic adjustment model
- Does this explain the data?